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UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

ANNUAL REPORT AND INVESTIGATIVE PROGRAM

1933 - June 13, 1934

NORTHEASTERN FOREST EXPERIMENT STATION

NEW HAVEN, CONNECTICUT

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Forest Service

NORTHEASTERN FOREST EXPERIMENT STATION

New Haven, Conn.

ANNUAL INVESTIGATIVE PROGRAM

June 15, 1954

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Appointed by the Secretary of Agriculture to serve in an advisory capacity to the Northeastern Forest Experiment Station and to coordinate and stimulate forest research by all agencies in the Northeast.

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NORTHEASTERN FOREST EXPERIMENT STATION

Personnel

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Guy R. Stewart	Senior Forest Ecologist
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Paul W. Stickel	Associate Silviculturist
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Bureau of Entomology

H. J. MacAloney	Assistant Entomologist

Bureau of Biological Survey

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Collaborators

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H. J. Lunt)	Station
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NORTHEASTERN FOREST EXPERIMENT STATION

Annual Report for 1934 and Investigative Program

General

The various emergency relief activities which developed during 1933 occupied a large part of the attention of the Station staff during the year, and made possible the accomplishment of the major part of the development work contemplated for our experimental forests and of the undertaking of much cultural work which would not otherwise have been possible.

Civilian Conservation Corps

Crews from Civilian Conservation Camps have been utilized since the establishment of the camps for a variety of work on the Gale River and Bartlett Experimental Forests in the White Mountains and for this spring's planting work at the Chenango Experimental Forest in New York. The work accomplished by the conservation camp crews on each forest may be summarized briefly as follows:

Gale River Experimental Forest

Completion of graveled loop road in western part of the tract about 2 miles in length.

Completion of road from the administrative site across the swamp and extending west to the northern end of the loop road, about 1 mile.

Clearing of several miles of old log roads.

Removal of dead trees and unsightly brush along public roads through the forests.

Painting of forest boundary and permanent cruise lines.

Eradication of Ribes for blister rust protection of 540 acres on east end of forest in 1933. Extension and repetition of this work in 1934.

Planting of about 100 acres of unsatisfactorily stocked old burn in 1933 and 1934.

Experiments in releasing plantings made in 1925 and 1926 from overhead competition by poisoning, girdling, and cutting.

Reduction of overhead competition on area planted in the fall of 1933 by poisoning.

Preparing land for planting by poisoning of alder thickets; some cut, others uncut.

Releasing 5 acres of desirable softwood understory by removal of hardwood for fuel.

Selective cutting of 3 experimental plots of pure spruce 90 years of age.

Girdling to stimulate growth of spruce on 2 5-acre uncut methods of cutting plots.

Pruning of selected spruce trees in 50-year old stand of spruce and fir over an area of about 50 acres.

Bartlett Experimental Forest.

Continuation of work on the Louisville Brook loop road. The road system at Bartlett will not be completed until the fall of 1934.

Brushing out of several miles of old log roads. Under this heading should also be included the construction of a skee trail from the top of Bear Mountain the lower end of which crosses the Exper-

imental Forest.

Painting of Experimental Forest boundary and permanent cruise lines.

Eradication of Ribes from the north end of the Forest and adjacent territory in 1933.

Piling and repiling of cordwood in study of solid contents of stacked wood.

Clear cutting of one 5-acre plot and selective cutting of another plot of the same size as initial operation in 5-year plan to compare these two methods of operating in northern hardwoods.

Construction of fire line around area for experimental burn and assistance in control of experimental fire.

Weeding of areas cut over for fuelwood between 1920 and 1930. Only a start was made on this job in 1933. The bulk of the area will be gone over this season.

Pruning of selected pine on an area of about 15 acres on the north end of the Forest.

Poisoning of undesirable over-story on portions of the planting area.

Maintaining meteorological records throughout the 1933 season.

In addition to the jobs listed above, from 2 to 4 men have been made available continuously for general research assistance and odd jobs about headquarters at both the Bartlett and Gale River Forests.

On the Chenango Experimental Forest in New York a crew of from 30 to 70 men was furnished by the Sherburne Camp for the planting of 96,000 trees this spring. A crew of 20 men from the Pharsalia Camp is completing a pipe line from the spring to the building site which

was started during the winter by the C.W.A.

National Industrial Recovery.

National Industrial Recovery funds are being used to erect buildings on each of the Experimental Forests to provide adequate facilities for office and laboratory work, for the storage of government automobiles and equipment, and for housing staff men while assigned to the Experimental Forests. At both the Gale River and Bartlett Experimental Forests the construction includes:

a. A 30 x 36' 1½-story headquarters office and laboratory building with space for housing and feeding a crew.

b. A 3-room cottage for housing of staff members.

c. A 3-car garage.

The contract at Gale River also included the construction of 1½ miles of power lines to bring commercial electric current to the buildings. Construction at both Gale River and Bartlett has been completed and it only remains to do some additional grading and land scraping to put the headquarters sites in finished condition.

On the Chenango and Finch Pruyn Experimental Forests in New York a 3-room combination office-dwelling, a 2-car garage, and a woodshed are being constructed. The job at each place includes the development of a water supply. The Finch Pruyn building site is furnished by a commercial power line, but is not practical to provide electricity for the Chenango buildings. Construction is well under way at the Chenango Forest. Bids for the Finch Pruyn job will be opened on July 6th.

Civil Works.

Our initial Civil Works authorization provided for the employment of 80 people in New Hampshire, 10 in Connecticut, and 10 in New York.

The work in Connecticut was delayed in starting but 10 people were engaged in stenographic, computing, and shop work from December 26 until April 27. These people were employed in the recomputation of fire weather data at four stations, in the preparation of hardwood volume tables, in the transcription, checking and computation of records of permanent sample plots and phenological reports, in transcribing about 6,000 tree measurements to the new graphical record forms, in mounting and labeling herbarium specimens, in the construction of relief maps of the Gale River and Bartlett Experimental Forests, in the preparation of topographical maps and of charts for several publications, and in miscellaneous stenographic and office activities. In New York 10 men were employed between December 8 and February 17. A topographic survey of the entire Chenango Forest was made. On about 15 acres of swamp land surface ditches were dug to improve conditions for planting. Undesirable growth was poisoned in several compartments to prepare the sites for planting experiments during the next 2 years. The plots to be planted this year were carefully surveyed and staked out. About 700 feet of ditch was excavated from the pipe line to the spring on the headquarters site. After the first of the year the work was severely handicapped by abnormally cold weather and the reduction of the work schedule to 12 hours per week.

The New Hampshire authorization was divided between the Gale River and Bartlett Experimental Forests. At Bartlett the main activity was the construction of a new truck trail on the lower slopes of Mount Haystack. About 2,000 feet of old logging road was graded and ditched, and another 3,000 feet of new road was graded and made ready for surfacing and installation of permanent culverts. Because effective work on this job became impossible as the winter advanced especially after the work schedule was reduced to 12 hours per week, operations at Bartlett were discontinued on February 15 except for a few odd jobs at headquarters. Miscellaneous work on the maintenance and improvement of headquarters buildings included the installation of 130 feet of pipe line to drain the basement of the old dwelling; replacing of bulkhead affording access to the cellar; painting the old building outside and in; construction of woodsheds for the new buildings, storage boxes for government blankets, and of winter shutters for all windows. At the Gale River Experimental Forest the crew was employed continuously until the termination of the work on April 26. The major activities included :

a. Clearing and straightening stream channel, installing large culverts over old railroad grades, and construction of about 1/2 mile of surface ditches to drain the big swamp in the eastern part of the Forest. This work was not completed but will be carried on by C.C.C. crews this summer.

b. Clearing and grading 1/2 mile of new truck trail.

c. Weeding of about 2 acres of second growth spruce forest.

d. Cutting and burning of alder growth on areas to be planted in 1934.

e. Miscellaneous work in the development and improvement of the administrative site such as grading and graveling 400 feet of new driveway, digging ditches for water line connections and for installation of fire hydrant, construction of woodsheds, making winter shutters for the new buildings, transferring telephone lines to new poles, construction of various items of furniture for the new buildings.

A part of the Station's C.W.A. authorization was used in each of the three States to participate in the nation wide study of wood use in manufacturing during 1933, technical foresters being employed for this purpose.

Lumber Code

Since early last fall considerable time has been devoted to assistance in the formulation of conservation measures under the Lumber Code of the northeast. The Director has attended all the meetings which have been held by the Northeastern Lumber Manufacturers Association in New York in this connection, and has consulted and discussed proposed measures informally with several forestry agencies in the region.

American Forestry Association Meeting

In September, 1933, the American Forestry Association and affiliated organizations held their annual meeting on the White Mountain National Forest. A part of the program on two days was devoted to inspection of the Gale River and Bartlett Experimental Forests. The Station spent considerable time in preparation for

this meeting and the demonstrations put on received very favorable comment. In addition to planning to show various stages of our experimental work in the field, a photographic album 14 x 17" in size was prepared in which all lines of the Experiment Station's activity were illustrated. Two copies of this album were available in the lobby of the headquarters hotel for the three days of the meeting.

Research Council

Two meetings of the Northeastern Forest Research Council have been held since the last annual report. In September, 1933, a meeting was held in the White Mountains in connection with the American Forestry Association meeting. In addition to participation in the inspection of the Experimental Forests, the Council took one afternoon for a business session at the Hotel Howard in Bartlett. The major topic for discussion at this meeting was the prospective development of the Conservation Article of the Lumber Code. The winter meeting which was scheduled for February 21 in New Haven was attended by only a small number because of the blizzard which occurred the preceding day. The interrelation of wild life and forest management was the major subject on the program, and representatives of the game departments of the various States had been invited to participate. Since the last annual report the Research Council has lost Director R. T. Fisher of the Harvard Forest, by death. New members appointed are Jerome J. Farrell, president of the Farrell Lumber Company, Walton, New York, and S. A. York, conservation commissioner in Massachusetts, and S. B. Copeland, Eastern Manufacturing Company, Bangor, Maine.

Cooperation

Cooperation of the Bureau of Plant Industry, Entomological and Biological Surveys have continued on practically the same basis as heretofore. In Pathology Dr. Spaulding has had the assistance of Mr. Hansbrough, and in addition the Bureau had several men actively engaged in this region in connection with the E.C.W. program. In addition to Dr. Spaulding's regular work outlined in the project sheets, the Bureau has devoted considerable attention to the beech Nectria in Maine and to the Dutch elm disease in southern New England.

Dr. MacAloney has actively assisted in furthering insect control work by the Civilian Camps in this region and is responsible for federal approval of all such projects here. The Conservation Camps in Connecticut have conducted an aggressive campaign to control the European pine shoot moth, and it is interesting to note that coincident with this effort the severe cold weather of the past winter has reduced the population of the shoot moth at least 95 percent.

The Biological Survey has entered into a cooperative agreement for the use of the Pillsbury State Forest in New Hampshire for experiments on the interrelation of wild life and forest management. Mr. Miller, who had remained in Amherst to complete his studies of relation of birds and animals to the white pine weevil, has removed his residence to the Pillsbury Forest in New Hampshire. This does not afford very close contact with the Experiment Station but there should be no difficulty in maintaining satisfactory cooperation between the two agencies.

Active cooperation with the White Mountain National Forest has continued in connection with work on the Bartlett and Gale River Experimental Forests. The Forest has been very generous in approving projects for work on the Experimental Forests and, as described above, a very substantial volume of work has been accomplished. The Experiment Station was not called upon to participate actively in the formulation of a program on cultural work for the Forest as a whole at first, but during the winter arrangements were made for Westveld to inspect the operations at a number of camps and to discuss with camp superintendents and foremen the results of his studies on the management of spruce with special reference to girdling of undesirable hardwoods. During the winter members of the Experiment Station staff also participated in a conference of the White Mountain Forest staff to review the accomplishments in cultural work of the Conservation Camps to date and to revise the program for the coming year. Last fall opportunity was presented for members of the Experiment Station staff to go over in the field several of the investigative projects which Ranger Van Nort has under way on the Green Mountain unit.

During the past year cooperation from 21 persons in the region was obtained in connection with the phenological project. This number is discouragingly small but the records for the current year should be far more adequate than in the past because of cooperation which is being obtained from a number of the C.C.C. camps. Through the State foresters circular letters were sent to all the camps asking for assignment of a man to make phenological observations

throughout the season, and the response has been quite gratifying.

Experimental Forests

Development of the experimental forests already established has advanced very substantially as a result of the emergency activities described above. A very large portion of the Station's activities during the past year was confined to the experimental forests.

The difficulties encountered in the preparation of satisfactory form of agreement for the cooperative use of the Finch Pruyn Experimental Forest have finally been overcome, and this area may now be formally added to the list of experimental forests in the northeast. A second experimental area in New York has been made available to the Station by the New York Conservation Department. This is a tract of about 623 acres of land about 15 miles from Norwich which is typical of a large share of the submarginal farm lands being acquired by the State for reforestation. This area will be used primarily for our planting experiments and a substantial amount of work is already under way.

During the winter an offer of the use of a tract of about 1,600 acres in northwestern Massachusetts was received from Williams College. This tract would serve well for studies on the rehabilitation of lands formerly devoted to agriculture but now in various stages of regrowth, and generally in a very unsatisfactory productive condition. Problems associated with the management of lands of this sort are of wide significance in the northeast and favorable action on the proposal of Williams College has been recommended.

Publications

During the past year the following publications have appeared from the experiment station.

Behre, C. E. 1933. Northeastern Forest Experiment Station Attains Ten Years of Age. Jour. For. 31(6):694-695.

Jensen, Victor S. 1933. Relief Map Construction. Jour. For. 31(4):477-478.

Morey, H. F. 1933. Abstract of "Studies of Tree Roots". Jour. For. 31(8):984-986.

Reineke, L. H. 1933. Perfecting a Stand-Density Index for Even-Aged Forests. Jour. Agric. Res. 46(7):627-638, illus.

Spaulding, Perley. 1933. Dietrich Preferable Authority for Cronartium ribicola. Phytopathology, 23(2):203-204.

Stewart, Guy R. 1933. Forest Plantations Injured by Roosting Birds. Jour. For. 31(4):421-423.

Stickel, P. W. 1933. Experiments with Calcium Chloride as a Forest Fire Retardent. Jour. For. 31(5):523-542, illus.

Stickel, P. W. 1933. Drought Injury in Hemlock-Hardwood Stands in Connecticut. Jour. For. 31(5):573-577.

_____ 1933. Relation of Forests to the Evaporating Power of the Air. Jour. New England Water Works Assoc. 47(3):229-238, illus.

_____ 1933. Review of "Vergleichende Untersuchungen der Ertragsleistung reiner Kiefern-Stangenhölzer nach Karlschlag und reiner Kiefern-Althölzer aus Naturverjüngen unter Schirm" by Karl Hennecke. Jour. For. 31(5):611-613.

_____ 1933. Review of "Uber den Einfluss des Kahlschlages auf den Verlauf der Biologischen und Biochemischen Prozesse im Waldboden" by L. G. Romell. Jour. For. 31(7):857.

_____ 1933. Review of "The Disease of Slavonian Oaks Caused by Ceratostomella merolinensis n. sp." by P. Georgevitch. Jour. For. 31(7):865.

Westveld, M. 1933. Experimental Cutting Area in the Adirondacks. Under "Briefer Articles and Notes", Jour. For. 31(5):599.

_____, Recknagel, A. B., Churchill, H. L., and Heimburger, C. 1933. Experimental Cutting of Spruce and Fir in the Adirondacks. Jour. For. 31(6):680-688.

The following manuscripts are to be published or completed for publication during the fiscal year 1935.

Behre, C. E. Statistical Studies of Factors Involved in the Application of Form Class Volume Tables. Estimated 78 typed pages, 16 tables, 10 figures. For Journal of Agricultural Research.

Reineke, L. H. Discussion of Demeritt and McIntyre's Method of Constructing Tree Volume Tables. For Journal of Forestry.

_____ A Movable, Constant-Orientation, Lookout Mapboard. For Journal of Forestry.

Stickel, P. W. Weather and Forest Fire Hazard in the White Pine Type of Central New England. Typed 107 p., 21 figs. Submitted for publication as technical bulletin by Department.

_____ Forest Fire Damage Studies in the Northeast I. Bark Beetles and Fire Damage Hardwoods. Typed 6 p. Submitted to Journal of Forestry.

_____ Translation of "Studien über Naturliche Humusformen" by P. E. Müller. To be ready late in 1935. Estimated 300 typed pages.

BOTANY

Project

Phenological observations of forest vegetation in the Northeast. (Bp)

Scope

(a) To correlate observations of the leafing, flowering, and fruiting habits of trees, shrubs, and herbaceous vegetation with such natural phenomena as forest fires, the emergence of insects, and the fruiting of fungi, which are considered as important operating factors in all phases of forestry work.

(b) Since physiological functions of plant life are directly dependent upon variation of climatic conditions, the phenological observations will be correlated with meteorological records wherever possible.

Status

(a) Since 1930, when the phenological project was initiated, 21 individuals and institutions have been cooperating in securing data on the leafing, flowering, and fruiting of selected forest vegetation. At the close of each year the cooperators forward their data to the station for filing and summarization.

(b) Year-long evaporation records from Bates evaporimeters by 10-day intervals for each month were secured at Amherst, Massachusetts, from 1927 to June, 1932. Since the summer of 1931 complete meteorological records have been obtained at the Gale River and Bartlett Experimental Forests in the White Mountains.

Results

(a) During the past year three new cooperators were added to our list which now includes 21 persons and agencies. A small amount of the data was summarized, but no significant results were obtained due to the short period during which the project has been carried.

Plans for Fiscal Year 1935

(a) Phenological data will be secured from the present cooperators and cooperation will be sought from other individuals who may be interested in this type of work. This year cooperation is being obtained from many of the Civilian Conservation Corps Camps in the region. As opportunity presents itself, cooperators will be contacted from time to time. A summary of the results of observations for the five years since the work was started will be made before the 1935 growth season.

(b) The meteorological stations on the Experimental Forests in the White Mountains will be continued.

Assignment

H. F. Morey, with cooperation of interested agencies throughout New York and New England.

FORESTATION

Project

Forest planting in the Northeast (F-1)

Scope

Studies of the scientific basis of forest planting in the Northeast along the following lines:

1. Methods of planting, aimed at increasing success and reducing the cost of forest planting.
2. The establishment of mixed stands, especially of hardwoods and conifers.
3. Methods of reforestation for areas of poor drainage or heavy competition.
4. Questions relating to the source of seed will be given incidental attention from two angles -
   (a) Development of uniform system of nursery records for identification of the source of seed in each plantation.
   (b) Testing adaptability of promising strains of desirable species.

Status

During 1931 and 1932 the major portion of the work was devoted to a survey of representative forest plantations in the Northeast. In addition, in 1932 studies were made on planting technique and planting costs in five states of the region. Staked rows were set out on each planting job visited and examinations have been made

later to determine the vigor, survival, and growth as affected by the type of planting site and the depth of setting.

Small plantings of second generation Scotch pine, selected by the New York State Conservation Department at Boonville, New York, were made in 1932 at ten places in New England. These plantings were extended by setting out two acres additional at each locality during the spring of 1934.

In the spring of 1933 a series of some 31 quarter-acre plots were set out at North Branford, Connecticut, on the lands of the New Haven Water Company. These plantings were for the purpose of finding the effect of the depth and method of setting trees upon survival and root growth. A more extensive series of 96 plots were set out at the Chenango Experimental Forest, Smyrna, New York, as a part of the same study, in the spring of 1933.

In the fall of 1933 the survival and growth of the plots at North Branford and at the Chenango Experimental Forest were determined. Examination of the root development of the planted trees was also made at North Branford.

During the fall of 1933 the weed trees in Compartment 4, Chenango Experimental Forest, were poisoned with sodium arsenite, using the Cornell tree killing tool. The weed trees in portions of Compartments 10 and 13, amounting to 26½ acres, which had been used for the 1933 experimental plantings, were also treated with sodium arsenite.

In December 1933 and January 1934 surface drainage ditches were laid out in wet portions of Compartments 5 and 12, using C.W.A.

labor. One-fourth of the weed trees in the drained and undrained parts of Compartment 12 were poisoned with sodium arsenite and one-fourth with saturated sodium chlorate (Atlacide) solution. One-half the weed trees in Compartment 3 were poisoned with sodium arsenite and a half with saturated sodium chlorate (Atlacide) solution. The weed trees in the south half of Compartment 2 have also been poisoned with sodium arsenite during this same period. These experiments are aimed to remove overhead competition from areas required for controlled experiments on the method of planting and to study means of reforestation of areas of poor drainage and heavy brush competition.

Mr. Miller of the Biological Survey made a two-day reconnaissance of wild life on the Chenango Experimental Forest in December, 1933. Subsequent observations will serve to show changes in habitat conditions resulting from reforestation of the tract.

Results

A progress report on the plantation survey has been prepared and forms the basis for the scope of the project for the next few years as outlined above.

Only a few of the more outstanding conclusions of the survey will be indicated. It was found that white pine is the most important species used in reforestation. Study of the natural forest growth of the region shows that white pine has greater adaptability to a variety of conditions than any other forest tree, either native or introduced, that is now used in the region. It is believed,

however, that a mixed forest similar to that which was originally found here, is the most desirable type to establish. This conclusion favoring mixed plantings is influenced by a number of considerations. First among the advantages of mixed plantings may be mentioned the appreciable protection from weevil injury given the white pine by surrounding hardwoods. Second is the excellent growth and longevity of mixtures of hardwoods and softwoods. Third is the possible soil deterioration which may take place under pure plantings of conifers. Very few mixtures are now being used and these consist largely of row-wise mixtures of conifers. Hence it is felt that the development of the methods to be used in planting mixtures of hardwoods and conifers would be a valuable contribution for this station to make.

An examination was made in the spring of 1933 of the staked rows located on planting jobs in 1932. It was found that frost heaving was the principal winter injury which occurred in the New York State plantings. All the plantations were located on colloidal soils which are common in the reforestation areas. Wherever the grass cover was thin or the planting had been made on recently plowed agricultural land, the loss ranged from 20 percent up to 80 percent. The danger from heaving is sufficiently serious on the clay, clay loam, or heavy silt loam soils of New York State so that it is doubtful if successful planting can be done where there is not a continuous grassy covering.

We did not find that frost heaving was a serious problem in New England, unless the land had just been plowed and the soil

was decidedly colloidal. Plantings in Connecticut, Massachusetts, and New Hampshire, where the sod was removed from gravelly soils, had no loss from heaving.

Determination of the fall survival and growth of the experimental plantings at North Branford, Connecticut, and the Chenango Experimental Forest, Smyrna, New York, showed some notable differences in the mortality of the trees set by the three methods of planting employed in each place.

At the Chenango Forest there was a period of approximately two months of dry weather after the trees were set out. Under these rigorous conditions the 2-1 transplants had a better survival than the 2-0 seedlings. It was found, however, that the trees set with the dug hole and their roots spread, in all cases had a better survival than trees of the same age and species planted either in a slit or by the Harvard tool. It is not possible to state whether the better survival is due to a wider distribution of the roots, or to the cultivation of the soil, or the temporary removal of the herbaceous and grassy cover which competes with the trees for moisture. The success of the dug hole method will depend on the amount of heaving which occurs during the spring of 1934. The attempt was made to have the workmen place some of the grass sod on the outer part of the dug hole area, so as to aid in establishing a grass cover as soon as possible. The trees planted very low by the mattock slit or Harvard tool, had an appreciably higher mortality than the normally planted trees. There were, in some cases, indications that planting slightly low resulted in a greater

loss than planting at normal depth.

In the experimental plantings at North Branford, Connecticut, three species were used, Norway pine, white pine, and white spruce. Moisture conditions were favorable during the summer season and the survival of the Norway pine and white pine ranged from 80 to 98 percent. The trees set very low, in general, had a lower survival than the other depths of setting. The survival of the white spruce was somewhat poorer, but the trees set high had a greater mortality than those planted normally or slightly low.

The study of the root systems of the trees at North Branford showed that the Norway pine trees set very low had a materially poorer root system than the other depths of planting. Many of the ends of the roots, where the trees were set extremely low, had decayed and sloughed off. The dug hole plants of Norway pine had materially better root systems than those developed during the first year from slit planting.

With white pine there was an appreciable loss of vital roots in the trees set slightly low or very low. The trees of this species set with a dug hole and the roots spread in every case had the best development for each depth of setting.

In the white spruce, the trees set with a dug hole had again the best first year development. The white spruce set low were beginning to develop a new root system close to the surface of the ground and part of the lower roots were definitely turning upward towards the ground level.

Plans

Primary emphasis for the year will be placed on preparation of a progress report on studies of methods of planting during the past two years.

Growth, survival, and root development of the 1933 experimental plantings at North Branford and the Chenango Experimental Forest will be studied. The staked rows laid out in the 1932 plantings throughout the region will be examined and root development of properly and improperly set trees carefully studied.

The work with Boonville Scotch pine has been continued by the planting by cooperators of two additional acres at each of nine locations in New England. All of these plantings will be examined this year.

Approximately 96,000 trees have been planted this spring on the Chenango Experimental Forest with C.C.C. labor in the development of a comparative group of pure and mixed plantings and in further experiments on the method of planting. These experimental plantings will be extended in the spring of 1935. A sufficient number of staked plots will be laid out in the 1934 plantings to enable us to determine growth and survival in the fall of 1934 and succeeding years.

Assignment

Guy R. Stewart and H. F. Morey.

MANAGEMENT

Project

Management of spruce hardwoods. (M-1)

Scope

To determine the best methods for increasing the productivity of existing stands in the various spruce types of the region. The project includes studies in (1) methods of cutting; (2) natural reproduction; (3) girdling; (4) weeding; (5) thinning; (6) slash disposal; (7) forest soil types; (8) management problems on the Gale River Experimental Forest.

Status

Approximately 420 temporary plots, aggregating about 70 acres, representing a wide variety in age of cutting and stand composition, and 182 permanent plots totaling 273 acres established in representative spruce types of the region, form the basis of the study. The distribution of the permanent plots among the various phases of the study is as follows:

Phases of Study	No. of Plots	Area in Acres
Methods of cutting	138	190.73
Girdling	19	46.75
Weeding	10	3.25
Thinning	7	2.50
Slash disposal	14	31.95
Total	188	275.18

The soil phases of management studies as well as reproduction are being conducted on many of the permanent sample plots. Only six new permanent sample plots were established during the past year,

all of which were located on the Gale River Experimental Forest.

Progress for 1933

Special forestry funds available under the National Industrial Recovery Act made possible a substantial extension of the ground work for broad scale accomplishment in spruce management studies. Most of the progress, however, is confined to developmental work on the Gale River Experimental Forest. Strictly investigative work, due to curtailment in silvical funds, was confined to remeasurement of permanent sample plots and the establishment of a few new cultural plots.

A set of three two-acre slash disposal plots, two methods of cutting plots, and a series of three weeding plots, all located in Waterville Valley, New Hampshire, were remeasured mainly through special assistance of the C.C.C. The girdling plot at Bolton, Vermont, was also remeasured. Routine remeasurement work on a series of methods of cutting plots on Finch Pruyn holdings as well as a pair of girdling plots established the year before on the Finch Pruyn Experimental Forest in the Adirondacks was accomplished through the aid of forestry school students attending the summer session of the Forestry Department of Cornell. A committee consisting of prominent New York lumbermen and pulp and paper men made the selection of the plot to be girdled.

In the slash decay study Doctor Spaulding gave special attention to the ecology of the slash rotting fungi with reference to moisture relations, as this factor appears to be of especial significance. The season was abnormal in that the examination of

early summer showed no fruiting, but in late summer and fall fruiting was abundant.

A series of six new plots, each a quarter-acre in size, was established in an 8-year old planting of white spruce under a 30-year old aspen stand to study the effect of girdling and poisoning with sodium arsenite to release the young plantation.

Two reproduction transects were established on the big Tahawas burn of 1932 in the Adirondacks in cooperation with the Forestry Department of Cornell University.

Readings on the two meteorological stations at Cherry Mountain and one at Gale River are being maintained. Tallies were also kept up to date on the seed bed condition plots at Cherry Mountain.

Considerable progress was made during the winter and early spring months in compilation of data from the cruise plots established on the Gale River Experimental Forest as well as temporary plots established in earlier years throughout the spruce region in connection with the study of increment on cut-over lands.

The 153rd C.C.C. Company, located within a mile of the Gale River Forest, was a valuable aid in carrying out the developmental program on the Forest. The accomplishments may be enumerated as follows:

1. Spring planting of approximately 40 acres and fall planting of approximately 20 acres on a 30-year old burn supporting low quality aspen. The stock planted was equally divided between red pine, white pine, white spruce, and Norway spruce.

2. Release cutting and poisoning of aspen overtopping 20 acres of white spruce planted in 1925 and 1926, and an additional 60 acres of the same type planted in the spring and fall of 1933.

3. Eradication of Ribes on approximately 540 acres on the eastern portion of the Forest.

4. Swamping out fourteen miles of old log roads.

5. Construction of approximately three miles of gravel surfaced road and improvement work on two additional miles.

6. Cutting of a ten-acre tract of northern hardwoods with understory of spruce and fir reproduction to demonstrate the feasibility of conversion to pure pulpwood stand.

7. Clear cutting, light selection cutting from below, and light selection cutting from above in 120-year old pure spruce stand on a series of experimental cutting plots in Cherry Mountain experimental area.

8. Girdling of two 5-acre experimental plots in the Cherry Mountain experimental area.

9. Initiation of pruning work in a unit on the Gale River Experimental Forest devoted to the production of spruce saw timber.

10. Intensive roadside cleaning on the Gale River Experimental Forest roads.

Nira funds provided the means of starting construction of a set of headquarters buildings for the Forest consisting of office and laboratory, dwelling, and garage.

Availability of C.W.A. funds early in December made possible

the initiation of an interesting experiment in swamp drainage and the experimental clearing of alder patches by cutting and stump poisoning in preparation for planting, as well as the construction of a new piece of road extending into the southwest corner of the Forest.

Reports

Westveld, M. Short article under "Brief Notes" in the May edition of the Journal of Forestry, Vol. XXXI, No. 5, 1933.

_____, et al. Experimental Cutting of Spruce and Fir in the Adirondacks. Journal of Forestry, Vol. XXXI, pp. 680-688. 1933.

Plans for Fiscal Year 1935

During the spring planting of the open and aspen type areas was completed with C.C.C. labor. These plantings extended into areas from which alders had been removed by cutting and poisoning. A series of about 45 staked plots of 100 trees each will be established in these plantings to follow success of the various species and mixtures over a period of years.

The drainage of the big swamp along the old railroad right of way started by C.W.A. labor will be completed as a C.C.C. project. A series of study plots involving tagged trees, reproduction counts, and soil wells will be established in transects through the swamp to study the effect of changes in the water level. Much of this plot work will be completed before drainage is accomplished. Several permanent spruce yield plots established in 1928 will also serve to study the effect of the drainage.

Sale of the timber on Mount Deception by the White Mountain National Forest makes necessary the immediate retally of the ten 5-acre methods of cutting plots established there in 1930, and running of the reproduction strips on these plots. This job is being assigned to Morey under Westveld's direction.

Pruning of selected trees in a compartment of nearly pure spruce and fir which is to be managed for saw timber production has been in progress in a small way during the winter. The work is now being completed with a larger crew of C.C.C. boys. The permanent cruise plots in this compartment will be used for a record of the results of this work.

About a month's time will be spent, during the summer, relocating and remeasuring plots established in Maine during 1925 in the study of growth on cut-over lands. After the first of October Westveld's major effort will be directed toward completion of a report on this phase of the project. Data collected during past years have been summarized and tabulated, and the material is in shape for intensive analysis. Westveld will work up this material during a training assignment in Washington next winter.

Because of the loss of records in the fire which destroyed the old field station in March it will be necessary to reinventory the timber and reproduction on eight cruise lines at the western end of the Forest. It is planned to have a crew led by Morey do this work in the fall after all plot work has been completed. Compilation and analysis of the cruise plot data should be completed during the winter.

Other jobs requiring attention this year include remeasurement of six girdling plots at Waterville, three slash disposal plots at Johnson Brook, four methods of cutting plots at Cherry Mountain. Recurrent jobs include tally of reproduction of seed bed condition plots at Cherry Mountain and maintenance of meteorological stations at Gale River headquarters and on the Mount Deception plots.

Assignment

M. Westveld, H. F. Morey, and Perley Spaulding.

MANAGEMENT

Project

Management of central hardwoods. (M-2)

Scope

To determine the best methods of cutting central hardwoods and to develop effective silvicultural measures to improve the quality and growth of existing hardwood stands of varying composition and age. Studies included are (1) methods of cutting and cultural practices such as weeding, girdling, and thinnings; and (2) establishment and development of reproduction following different methods of treatment.

Status

Permanent plots established at various periods in the past form the basis of this study. Of a total of 32 plots aggregating 28.76 acres, 22 consist of two series established near Farmington and Windham, Connecticut, in 1906 to study the development of coppice stands following thinning. Another series of 5 located near Simsbury, Connecticut, were established in 1924 by the Station to study the immediate and future effects of fire in a 20 year old sprout hardwood stand, and the effect of thinning in such stands. Two additional sets of 23 plots at North Andover and Dover, Massachusetts, comprise the remaining plots. These were originally established by the Bureau of Entomology in 1913 to determine how to develop stands resistant to the gipsy and brown-tail moths through forest management.

Progress and results

Reports following the remeasurement in 1930 of the Windham, Farmington, North Andover, and Dover plots have been prepared by Jensen. The remeasurement of the five plots at Simsbury, Connecticut, was made this year.

Plans

Regular remeasurements will be made when due.

Assignment

M. Westveld, V. S. Jensen.

MANAGEMENT

Project

Growth, Development, and Management of Northern Pines and Hemlock. (M-3)

Scope

To determine the growth, development, and best methods of management of planted and natural grown northern pines and hemlock in both pure and mixed stands.

Status

No change in the status of the various permanent plots included in this project occurred during the year. Data from the pair of plots at Peterboro, New Hampshire, (N. H. 47-48) demonstrating the effect of liberating a young white pine stand from gray birch canopy were worked up in 1933 for use in connection with state programs of unemployment relief.

Progress

On Massachusetts Plots 5-7, at Mount Toby, Massachusetts, the herbarium collection was made, hardwoods on plots 5 and 6 were weeded, and all three plots remeasured.

Plans

Regular remeasurements will be made when due.

Assignment

Victor S. Jensen, Paul W. Stickel, and C. Edward Behre.

MENSURATION

Project

Development of Universal Taper and Volume Tables. (ME-1)

Scope

To study the characteristic stem form of various species in order to develop the possibilities of improving and simplifying the technique of estimating contents of standing trees by the use of universal or general taper curves and volume tables. Attention has been given to the following lines:

1. Conformity of various species to a form equation.
2. Improvement of technique for preparing volume tables by the form class taper curve method.
3. Fundamental principles of tree growth.
4. Factors affecting average form of stands.
5. Factors affecting butt swell and bark thickness.
6. Comparative form of species in mixture.
7. Change in form of residual trees after logging.
8. Application of universal taper and volume tables to certain species.

Status

Results under Objectives 1, 2, and 7 have been completed and published. Observations of the six trees being studied under Objective 3 will be continued periodically.

Progress for 1933

Report on Objectives 4, 5, and 6 has been practically completed. Calculations for all tables and charts to be used in the

final report were checked.

Plans for Fiscal Year 1935

Analysis of results to date under Objective 3 and preparation of progress report on this phase of the project.

The publication of a report on Objectives 4, 5, and 6.

Assignment

C. Edward Behre.

MENSURATION

Project

Growth and yield of spruce and balsam fir. (ME-2)

Scope

To determine growth and yield of spruce and balsam fir in different types and in even-aged and uneven-aged stands.

Status

Yield tables for even-aged stands have been completed and published.

Twenty-one permanent sample plots in Vermont and New Hampshire are serving to check the normal yield tables and provide information on mortality and approach of understocked stands to normalcy.

One permanent sample plot (N. H. 90) on the Gale River Experimental Forest was established in 1928 in an uneven-aged stand of spruce and fir in mixture with hardwoods. Nothing further has been done on this phase of the project.

Results

Normal yield tables for spruce and balsam fir from 25 to 115 years of age have been published, and some work has been done on the application of these tables to understocked stands.

Progress for 1933

The five-year remeasurements due in 1933 were made on Plots N. H. 81-91, inclusive.

Plans

Follow development of permanent plots, establish additional

plots in uneven-aged stands and hardwood mixtures when resources permit.

Assignment

L. H. Reineke.

MENSURATION AND MANAGEMENT

Project

Growth of northern hardwoods. (ME-3)

Scope

To determine the rate of growth and yield of northern hardwoods in different forest types and methods of management which will produce maximum growth.

Status

Much basic data for this project were accumulated in the intensive survey of the Bartlett Experimental Forest, for which the field work was completed in 1932. Continuous observations of meteorological conditions affecting growth, at three stations on the Bartlett Experimental Forest established in the summer of 1931, are being continued. Two of these are on the yellow birch thinning plots established in 1933. Of these plots, one is a check plot, the other is heavily thinned, though less severely than in ordinary commercial practice. Measurements of stem, top and limbs of the trees removed in thinning were made for volume table purposes. The products of thinning were sold as fuelwood and, as in the past, fuelwood has been sold from the Bartlett Experimental Forest to round out cut-over areas and dispose of material cut from new road right of ways.

Volume tables in merchantable cubic feet, and board feet by the International ($\frac{1}{4}$" kerf) and Scribner rules are available. The cubic-foot tables have been checked and revised and are in use by the

White Mountain National Forest. Tables of total cubic volume of stem and branches for paper birch and white ash have been prepared.

3 Records covering 25 years on permanent sample plots at Pomfret, Vermont, Sharon, Vermont, West Rochester, Vermont, and Corbin Park, New Hampshire, are available for analysis. Fifteen years' growth records on permanent plots at North Berwick, Maine, are at hand also.

4 For the study of yield, 37 semi-permanent intensive plots and 60 temporary plots established in 1932 are available. The intensive plot measurements include data on merchantability, form, defect, and rot.

5 An analysis of growth data from the Bartlett Experimental Forest Survey and the White Mountain National Forest Survey was made to determine the accuracy of the field work and to control the amount of data collected.

6 An instrument for holding and slicing of hardwood increment cores was developed to facilitate the counting and measuring of such cores without the aid of dyes or stains.

Progress for 1933

Limitation of funds restricted field work during the summer of 1933. Two semi-permanent intensive yield plots were established near Danby, Vermont. Milacre vegetation tallies were made on the two yellow birch thinning plots at Bartlett. A study of weeding of young stands of hardwoods to liberate desirable tree species was initiated with the establishment of nine tenth-acre and four quarter-acre permanent plots on the Bartlett Experimental Forest.

Two ten-acre tracts were laid out on the Bartlett Experimental Forest for a management study. One tract is being clear-cut, the other is being cut by a light selection system.

In connection with this cutting, and cutting done on new right of ways, a study of hardwood cordwood piling is being made to determine the cordwood volume of trees of various species and sizes, to determine solid contents of piled wood and the effect of splitting and bucking into shorter lengths on solid contents, and to measure the variation in piling of individual pilers and variation between pilers.

The use of a chute for the transportation of cordwood to the loading decks is being tested. A one-day demonstration test of the Wolf gasoline engine driven chain saw for felling and bucking cordwood was made.

A mirror stereoscope was built for examination of the stereoscopic photographs of the thinned yellow birch plot.

Relief maps of the Bartlett Experimental Forest, showing types, improvements, etc., are being made.

In connection with his study of defect in standing hardwood timber, Doctor Spaulding made an examination of some of the timber being cut on the Bartlett Experimental Forest last fall. It was found that yellow birches with low dead side branches 4" or more in diameter rarely have decay in the main trunk. The traditional resistance of this species to decay holds good with this type of defect. Overmature beech showed a large percentage of trees with hollow butts which weaken them so that they are windthrown. Such trees apparently nearly

ready to fall were found to have the rot running up only about 6 feet if there were no other defects in the top (other than large broken branches) or trunk. Defects in mid-trunk indicate total loss for lumber. Large broken branches in the crown, 10" or more in diameter at the break, require 4 to 6 feet cull from resulting rot running downwards. Defect in mid-trunk accompanying above means total cull.

Opportunity arose for similar work on the Green Mountain National Forest in an overmature hardwood stand. Here it was found that rot from hollow butts in yellow birch and sugar maple trees about 200 years old ran up about 12 feet. Open scars on sugar maple trunks caused by the maple borer showed no rot - the entire defect would slab off in the mill. Fruiting bodies of the common decay fungi indicated rot as at Gale River and Bartlett in earlier work.

Plans for Fiscal Year 1935

Volume tables in cubic feet, including branches, will be completed. Volume tables showing ties and dimension stock bolts are to be prepared.

Available permanent sample plot growth data will be worked up and progress reports prepared.

Stand tallies from the intensive survey of the Bartlett Experimental Forest will be analyzed as the first step in developing a method of growth prediction.

Measurement of selected stands throughout the region for further study of yield will be continued.

Meteorological records on the yellow birch thinning plots will be continued during the growing season. Additional plots will be established in the extensive series comparing clear cutting with light selection. Additional data will be gathered on the use of portable steel chutes for transporting fuelwood.

Weeding plots on the Bartlett Experimental Forest will be remeasured and additional plots established.

Data from the intensive survey of the Bartlett Experimental Forest will be worked up.

Records will be made of the development of vegetation on the management plots.

Assignment

L. H. Reineke, Victor S. Jensen, and Perley Spaulding.

PROTECTION

Project

Forest Fire Attack. (Pf-1)

Scope

The study of forest fire attack is divided into (a) the indirect or preventive phase characterized by the analysis of forest fire statistics and (b) the direct or control phase characterized by experimentation with new materials and methods for suppressing fires.

(a) The analysis of forest fire statistics has a twofold purpose, namely, to secure from available records accurate and complete information in regard to forest fire hazard, risk, and damage in different parts of the Northeast and to furnish forest administrators with such information as a guide in judging the efficiency of their protective organizations.

(b) The control phase of this project is concerned with testing the efficiency of new materials and equipment under actual burning conditions.

Status

(a) In cooperation with state forestry departments reports have been prepared setting forth the analysis of forest fire records for the years indicated: New Hampshire 1921-1925; Maine 1916-1925; and Vermont 1911-1926. The reports for the first two states have been published by the states indicated; no publication of the Vermont report is contemplated. For Connecticut the records for the years

1921-1925 have been compiled and copies of the various tables were distributed to the State Forester of Connecticut.

(b) Thus far, retardation and extinguishing tests on grass fire have been made with commercial calcium chloride and Zenith Fire Dust. The former material was found to have a limited use in forest fire control while the latter substance was found wholly ineffective.

Results

(a) No further work was done in the analysis of fire records.

(b) No tests were made with new material or equipment. During the year the following report of the work with calcium chloride was published:

Stickel, P. W., 1933. Experiments with calcium chloride as a forest fire retardent. Jour. For. 31 (5): 523-542, illus.

Plans for Fiscal Year 1935

(a) Until additional funds are available so that one man can be assigned to devote his entire time to cooperating with state forestry departments, no further work on the analysis of fire records will be undertaken.

(b) No tests with new materials or equipment are planned for during 1935.

Assignment

P. W. Stickel.

PROTECTION

Project

Forest Fire Behavior. (Pf-2)

Scope

The two major lines of investigation included under this project are:

(a) Study of weather and fuel relationships through instrumentation in order to determine what constitutes forest fire-weather so that the varying degrees of fire hazard can be recognized.

(b) Study of the prediction of forest fire-weather so that methods of forecasting the occurrence of dangerous periods of weather can be worked out more accurately and for longer periods in advance than is now possible.

Status

(a) No active field work has been done on this phase of the fire behavior study since 1930. The data from the four fire-weather stations have all been analyzed and the findings published. The report of the station at Cranberry Lake, New York, which was maintained in cooperation with the New York State College of Forestry during 1925-1929, was published as a technical bulletin of that institution in 1931. The Massachusetts Forestry Association issued a brief paper containing the results of the fire-weather study made in cooperation with the Harvard Forest at Petersham, Massachusetts, during 1926-1930. The biennial report of the Maine Forest Commissioner for 1931-1932 contained the summary of cooperative study made with the Maine Forest

Service at Smyrna Mills, Maine, during 1927-1930. Finally, a summarized account of the conclusions of the study at Elk Lake, New York, which was conducted from 1927-1930 in cooperation with the New York Conservation Department and Finch, Pruyn and Company was published in the Journal of Forestry, January, 1934.

(b) Approximately twenty-five special fire-weather stations are now furnishing reports from various points in New England to the Weather Bureau in Boston. Fire-weather stations in New York report to the Weather Bureau office in Albany. These reports are used in conjunction with the regular and special reports and forecasts issued from the Albany and Boston offices. New York, Maine, New Hampshire, and the White Mountain National Forest are furnished fire-weather forecasts regularly throughout the fire seasons.

Results

(a) The publication of the report of the Elk Lake fire-weather station has rounded out the series of reports covering the analysis of the data of the four fire-weather station. The more comprehensive and technical manuscript of work at the Petersham station has been accepted for publication as a technical bulletin of the Department. It is now in the hands of a board of review.

In general the work to date has shown that duff moisture content and degree of forest fire hazard can be successfully estimated from integrated measurements of relative humidity, air temperature, and number of hours since last measurable precipitation. The mechanism found to be most useful for integrating these observations is the alinement chart. Such charts are now available for the following types of forest cover: white pine, red spruce, and balsam

fir, and mixed northern hardwoods and spruce.

Although rate of evaporation is the factor most closely related to the changes in fuel moisture content and degrees of hazard, it was eliminated from consideration in the initial alinement charts because of the difficulty field men would have in measuring it. Recently a simple method has been devised in Canada for taking satisfactory evaporation measurements, and so the alinement charts for each of the four stations have been reconstructed using a 24 hour evaporation reading instead of relative humidity.

During the past year the following manuscript dealing with forest fire-weather was prepared:

Stickel, P. W., 1934. Weather and forest fire hazard with special reference to the upper altitudinal spruce-balsam fir region of northern New York. Jour. For. 32 (1) 76-79, illus.

(b) The regular forecasts and warning service of the past was maintained during the past year. The special daily distribution of fire-weather forecasts over the radio stations WBZ and WBZA was also continued as was the dissemination of forecasts and warnings by the press, telegraph, telephone, and weather maps. A special study was made of the relationship between winter precipitation and the subsequent spring fire season. The results of this study are contained in the following paper which was presented at the meeting of the American Meteorological Society in Chicago.

Reed, T. E., 1933. The unusually late spring fire season 1933 in New England (mimeographed), 9 p., 4 figs.

Plans for Fiscal Year 1935

(a) No new field work is contemplated. The revised alinement charts based on 24 hour evaporation, air temperature, and hours since rain will be used in a general fire-weather bulletin for the region, which it is hoped will be completed during the year.

(b) Routine fire-weather forecasts and warning service will be continued. As far as funds permit summations will be made of individual state fire-weather records and special studies such as that mentioned above will be undertaken.

Assignment

(a) P. W. Stickel in charge, assisted by Mary C. Weldon.

(b) T. E. Reed, Weather Bureau, in charge, in cooperation with the state foresters of New England and the White Mountain National Forest.

PROTECTION

Project

Ecological Effects of Forest Fires. (Pf-3)

Scope

To study the influence of forest fires upon standing timber, reproduction, and soil for the purpose of standardizing methods of appraising forest fire damage, and for the purpose of furnishing basic information pertinent to the reforestation and management of fire damaged areas.

Status

At the present time this project is mainly concerned with investigating (a) the basal wounding of trees by fire and (b) the relationship between bark character and heat resistance of trees.

(a) In connection with the study of the basal wounding of trees by fire six study areas were laid out in fresh burns during the summer of 1933. On these approximately 400 trees were numbered for future observation. On the tagged trees complete bark discoloration diagrams were made and notes taken as to the occurrence of insects and fungi. On approximately 50 of the tagged trees the bark was peeled after the bark discoloration diagrams were made to determine the relationship between exterior and interior wounding. During the fall an area approximately 15 acres in size was selected on the Bartlett Experimental Forest for burning in connection with this study. It has been divided into subplots and completely inventoried.

Attempts to burn this area during the 1934 spring season were only partially successful, the foliage developing fully before

the litter was dried out much below the surface. About four acres were burned over by a rather slow fire and about 600 trees will be available for study. The unburned portions of the area may be used as a check for the present.

(b) The preliminary field work of the above study indicated the need for determining just what makes one tree species more heat resistant than another. A study of bark characteristics seemed a logical starting point for such an investigation. A working plan was prepared outlining the various morphological, histological, and physical phases which such a study should embrace. Actual laboratory work dealing with the question of the seasonal fluctuation in bark moisture content has been started. Samples of hemlock, beech, chestnut oak, sugar maple, balsam fir, and pitch pine bark are being collected monthly and their water content determined.

Results

(a) Sufficient data have not as yet been accumulated to determine the exact relationship between bark discoloration and interior wounding for individual species. The data from the few trees which have been peeled appear to indicate that in general the entire area of scorching is a fair guide to the extent of cambial wounding. On the fresh burns used this past summer the relationship between insects and fire was brought out in a very striking manner. On one plot over 50 percent of the tagged trees showed the presence of ambrosia beetles whose work appeared to be confined entirely to the wood beneath the area of bark discoloration. The following manuscripts were prepared for this study:

Stickel, P. W., 1933. A working outline for the study of the influence of forest fire upon standing timber, regeneration, and site. Typed 8 p.

_____, 1933. Outline for working plan for the study of the basal wounding of standing timber and reproduction by fire. Typed 26 p.

_____, 1934. Forest fire damage studies in the Northeast I. Bark-beetles and fire damaged hardwoods. Typed 6 p. Submitted to Journal of Forestry for publication.

(b) Sufficient determinations of bark moisture content have not yet been obtained to make any report. The following manuscript was prepared in connection with this bark characteristic study:

Stickel, P. W., 1933. A working plan for the study of the bark character of trees in relation to their resistance to fire injury. Typed 26 p., 2 figs.

Plans for Fiscal Year 1935

(a) The areas established last year will be reexamined and the bark of a certain percentage of the tagged trees will be removed to ascertain the extent of original cambial wounding, the extent of initial callus growth, and the presence of decay due to insects and fungi. Bark discoloration diagrams will be made on all damaged trees on the experimental burn at Bartlett. The effect of the fire on reproduction will also be studied by retally of milacre quadrats on the burned area and the check.

(b) During the winter it is planned to make detailed histological study of bark specimens of the six species from trees

of different ages to learn more about the process of formation and activity of cork cambium. If time permits, heat resistance tests of the different barks will be made at the Forest Products Laboratory in the late fall or winter of 1935.

Assignment

P. W. Stickel, in cooperation with the Yale School of Forestry.

PROTECTION

Project

Chestnut blight (Pd-1).

Scope

To study the feasibility of replacing native chestnut with resistant species or hybrids, or by development of resistant races of the native species.

Status

Because of attacks of a native fungus on the oriental chestnuts set in the field, it may be that our greatest hope lies in the finding of resistant native trees or the breeding of resistant new varieties.

Results

The public is calling attention with increasing frequency to resistant native trees which are producing nuts. Experimental plantings of oriental chestnut have been made as follows:

Connecticut	1.	Dark Entry Forest, Cornwall Bridge	2600 - 1931
	2.	Eli Whitney Forest, Yale Forest School--- New Haven, (Professor Hawley)	1200 - 1931
	3.	Cockaponset State Forest, Haddam	1000 - 1931
	4.	Mohawk State Forest, E.Cornwall	1000 - 1931
	5.	Nye-Holman State Forest, Stafford Springs	1000 - 1931
Massachusetts	1.	Swann State Forest, Great Barrington	1500 - 1930
	2.	Amherst	25 - 1930
	3.	Sunderland, Mount Toby	100 - 1930
New Hampshire	1.	State Forest near Charlestown	2500 - 1931
	2.	State Forest near Nottingham	2500 - 1931
	3.	Hebeka Farm, Mr. Earl Burnell, Conway Center	200 - 1931

New York-----1. Bear Mt. State Park----------2400 - 1931
2. Arnot Forest, Cayuta, New York,
Cornell University Forest area-----2400 - 1931
3. Black Rock Forest, Mr. H. H. Tryon,
Director, Cornwall-on-Hudson-------2400 - 1931
4. Connecticut Hills State Game Preserve---------- 573 - 1931
5. Millbrook, N. Y., Mr. M.B.Cary, Jr.-1200 - 1931
6. Montgomery County Reforestation
Area, Charleston, N. Y. ---------- 349 - 1931
7. N. Y. State College of Forestry,
Syracuse, N. Y. ----------3000 - 1931
(Some planted in arboretum; some
lined out in School Forest Nursery;
and some planted on Allegheny State
Park, Red House, N. Y.)
8. Onandaga County Park, Fabins, N.Y.-- 25 - 1931
9. Pok-O-Moonshine Lot, Lewis, N.Y.---- 635 - 1931-2
(391 in 1931; 244 in 1932)
10. Saratoga County Reforestation Area,
Corinth, N. Y. ----------1036 - 1931
11. Saratoga Lake, Mr. T. O. Luther-----1200 - 1931
12. Warren County Sanitarium,
Glens Falls, N. Y. ---------- 604 - 1930
13. Bear Mt. State Park---------- 450 - 1930
Connecticut Hills State Game Preserve, Alpine, N. Y.---------- 466 - 1930
14. Horseheads State Forest Nursery,
Horseheads, N. Y. (near Elmira)----1890 - 1930

Rhode Island--1. Roger Sherman Park, Providence----1000 - 1931

The oriental chestnuts appear to be hardy but some were broken down by heavy masses of drifted snow. A native fungus is attacking them and killing twigs and leaders so that the outlook for the future is ominous.

The division of Forest Pathology is examining the plantations of oriental chestnuts carefully each year and noting their reaction to climate, fungi, insects, etc. A study of the native fungus which is attacking them is being carried on.

Plans for Fiscal Year 1935

To continue along present lines.

Assignment

Bureau of Plant Industry, Perley Spaulding.

PROTECTION

Project

White pine blister rust. (Pd-2)

Scope

Investigation of the disease for new developments in habits or character.

Status

Past investigations are published. Use of resistant species is advocated for critical areas or conditions.

Results

Experimental plantings of Pinus peuce have been made as follows:

Massachusetts:

Pelham, C. Edward Behre - 1932 - 1100

New Hampshire:

Keene, Yale Forest - 1932 - 100

Bethlehem, Northeastern Forest Experiment Station - 1932 - 300

Near Concord, State Forest Service - 1931 - 300-400

Vermont:

Near Concord, State Forest Service - 1932 - several seed beds very uniform in germination

Groton State Forest - 1929 - 2100

Maine:

Bingham, S. D. Warren Company nursery in 1933 had 3000 5-year transplants which were thrifty and would average 6 to 8 inches tall.

Ohio:

Wooster, State Forester - 1918 - 20

In 1932 these averaged 13.6 feet high.

Oregon:

Mount Hood, U. S. Div. Forest Pathology - 1931 - 700

A study of secondary fungi of blister rust cankers is under way.

Progress for 1933

During the past year the supposed immunity of Pinus peuce has been placed in doubt - indeed the evidence even makes its decided resistance doubtful. Tubeuf in a personal letter states that trees of pole size (15 to 20 years?) with many side branches are entirely healthy. But seedlings in the same vicinity 4 years old have become heavily infected and are dying. Moreover we found a single 5-year transplant at Bingham, Maine, which in our opinion certainly had died from the blister rust. Nevertheless we believe forestry tests should be made more generally and those now under way be continued indefinitely. It is especially fortunate that such tests are being made in the Pacific Northwest where this disease is now being intensively investigated.

In the last several years rigid tests have been made by the Division of Forest Pathology which prove that there is a really immune variety of cultivated red currant derived from the so-called "Norwegian Red". Because of uncertainty of descriptions of this ancient variety this has been named "Viking" with a careful description. There is so much confusion in the cultivated Ribes that the above procedure seemed necessary for identification purposes in the future.

The use of such an immune cultivated currant is exceedingly difficult if not impossible in practice in areas where cultivated Ribes are banned from use.

Publications and reports

A report on the Wilmington, New York, experiment covering the years 1918-1930 is being prepared.

Spaulding, Perley. Pre-eradication scouting - stop, look, and listen. Rept. Proc. Seventeenth Ann. Blister Rust Control Conference. pp. 27-28. 1932. Mimeographed.

_____ Dietrich preferable authority for Cronartium ribicola. Phytopathology 23:203-204. 1933.

Plans for Fiscal Year 1935

Routine studies only.

Assignment

Bureau of Plant Industry, Perley Spaulding and J. R. Hansbrough.

PROTECTION

Project

Shade and ornamental tree diseases. (Pd-5)

Scope

To answer inquiries on this subject.

Status

Entirely incidental and limited to local cases. A few cases require handling each year.

Results

Discovery of European larch canker. Investigation of willow scab with discovery of resistant willows.

In the winter of 1931-1932 much winter injury of various ornamentals occurred. The junipers and related species were especially damaged. Considerable damage to sugar maple shade trees has been noted as caused by the fungus Volvaria bombycina.

Progress for 1933

Consultation with Massachusetts state representative on treatment of trees on Willard Brook State Park. Advice on removal of dwarf mistletoe in white spruce on the grounds of Hotel Champlain, Plattsburg, New York.

Plans for Fiscal Year 1935

Routine examination of specimens submitted, and answer to inquiries.

Assignment

Bureau of Plant Industry, Perley Spaulding.

PROTECTION

Project

Miscellaneous forest tree diseases (Pd-6).

Scope

To include work upon forest tree diseases not covered by other projects.

Status

A collection of specimens of tree diseases is arranged for exhibit in the office, and many are collected and filed for reference. Literature on the tree diseases of the Northeast is indexed.

Results

The Nectria disease of birches and other hardwoods persists in serious character and is much more widespread and prevalent than has been supposed. The total damage caused is very large and appears to be almost overlooked by woodland owners. Stereum sanguinolentum assumes more importance in the forest. Dasyscypha diseases of conifers are being investigated.

Resinosis of red and white pines in New York plantations and similar trouble in Maryland has come to our attention. Investigation is underway by other agencies. A similar trouble of Douglas fir reproduction is known in Colorado. The cause is unknown.

No new plantings of larch with the European larch canker have been found, altho intensive search has been made for several years. The two known diseased plantations have been destroyed.

The Woodgate rust of Scotch pine has been reported from widely separated points in the provinces of Ontario, Quebec, and Nova Scotia.

The beech is dying extensively in Nova Scotia and New Brunswick from the attacks of the felted beech scale followed by Nectria. It has been found in Maine and Massachusetts this season. The fungus appears to be a weak parasite attacking the bark where the insect has worked previously.

Progress for 1933

On September 15, 1933, the office program for Emergency Conservation Work on defects of forest trees was approved and funds allotted for its execution. Doctor T. J. Grant was appointed Technician for work in New England, and assigned to New Haven as headquarters to work under our direction. The earlier and contemporary work of Doctors J. S. Boyce and D. S. Welch in direct education of C. C. C. camp foremen and gang leaders in recognizing these defects, their effect on the attacked trees and best methods of handling them in their forest improvement work, greatly facilitated the initiation of these E. C. W. investigations of the most urgent problems encountered in the forest improvement work.

After consultation with Doctors Boyce, Welch, and others, the following program was set up for Doctor Grant to follow:

Schedule of E. C. W. Research Work in Pathology

A. Nectria: To include all species of trees possible and in various localities to include varied environmental conditions: up to a maximum of 10 trees in each lot.

Lot I. Girdled and left standing
II. Felled and left lying
III. Felled and branches severed
IV. Felled and canker edges peeled for 3 inches
V. Felled and sections with cankers cut out but let lie
VI. Inoculations in healthy trees.

A. Nectria (Continued)

Also a detailed study of individual infected trees with reference to environment, etc.

B. Strumella: Similar to the Nectria study.

Lot I. Girdled and let stand
II. Felled and let lie (Checks)
III. Felled and cankers peeled 3 inches on edges.
IV. Felled and cankers covered with earth, leaves, etc.

Also a detailed study of single trees with reference to environment, etc.

C. Decay (Coppice): To cover all species of trees.

I. Stumps
Communication of rot from stump to sprouts
Communication of rot from sprout to sprout

II. Where 1 or more sprouts died or were cut ten or more years ago, determine growth stimulus to remaining sprouts - checks where none have gone. Take specimens of rotted wood for cultures.

D. Decay (Non-coppice): To cover all timber trees. Examine for extent of rot back of various external defects. Take careful notes, drawings, and photographs for all types, inside and outside. To cover all states and conditions possible. Take specimens of rot for cultures.

Because the Nectria and Strumella canker experiments for fruiting under various conditions must run several months to get results, these were started first. Some time necessarily was spent in prospecting for favorable locations for them, but very good progress has been made. A single series of Strumella experiments was begun in May, 1933, by us and this is the only suitable place for such an experiment that we have yet been able to find. However, ample tests of this fungus have been begun by E. C. W. investigators farther south in a very favorable location. Nectria experiments have been started and are now well under way in two of the Connecticut State Forests and in

the White Mountain National Forest in New Hampshire. The latter is especially notable, consisting of 325 trees of various sizes and species. During the summer of 1933, our regular force examined about 1,800 girdled hardwood trees in New York and New Hampshire, and Nectria was found fruiting abundantly on all species examined. Specimens of these, as well as numerous collections made everywhere we went, were turned over for identification to Doctor T. T. Ayers, who began in April, 1933, to culture and study the various Nectrias. A serious disease of beech caused by a bark piercing insect and a Nectria in the Canadian provinces of Nova Scotia and New Brunswick and which is extending into Maine and Massachusetts, led to the assignment of Doctor Ayers to the study of the Nectrias mycologically. In connection with his study, he and Doctor Grant made about 500 inoculations to learn whether the Nectria from one species of tree would attack other species, a matter of vital importance in the treatment of forests by the C. C. C. men. Besides this, Doctor Grant began a very careful detailed study of the Nectria cankers in individual trees in an effort to learn something of its life history and methods of attacking its hosts.

As early as last May our regular force tentatively investigated the occurrence of decay in coppice oak stands. It was found that this was a very intricate problem which would require much time and effort to yield reliable data. Doctor Grant has attacked this problem at odd moments and after the Nectria experiments were established. Because of the complexity of the problem no more than a beginning has yet been made. See Pd-8 for statement for this work.

Plans for Fiscal Year 1935

To be continued as at present, supplementing the work on other projects.

Assignment

Bureau of Plant Industry, Perley Spaulding, J. R. Hansbrough, and T. J. Grant.

PROTECTION

Project

Rots in balsam fir pulpwood timber. (Pd-7)

Scope

To determine the progress of decay in standing pulpwood timber as the basis for management to utilize all the balsam fir which the land produced and to avoid the usual waste from windfall and decay.

Status

Under the usual methods of operation in the spruce and fir forests of the Northeast all merchantable softwoods are removed. This leaves so little advance growth that a period of at least fifty or sixty years must elapse before another cut can be made on the same area. But before the end of this period much advance growth of balsam has grown to merchantable size, become infected with decay, and blown down by the wind.

Silvical study is now being given to the possibility of a system of partial cutting which will permit successive cuts on the same area at intervals of from 25 to 35 years, in the hope that most of the waste will be thus avoided. Concurrent pathological studies to determine relative frequency of various fungi, methods of infection, rate of spread, and conditions under which trees are most subject to infection are needed.

Sometime before 1924 studies of this sort were begun in Canada. Intensive analyses of rot conditions in two typical balsam stands, supplemented by prolonged cultural study of the rots involved, were

made. Similar work is necessary to determine the progress of decay under conditions found in the northeastern United States.

Results

Three rots have been found to cause most of the loss in balsam fir. Two are butt rots, one brown "charcoal" rot caused by Polyporus balsameus, and a stringy rot caused by Poria subacida. A third rot occurs in the upper and middle trunk and is commonly known as red heart. It is caused by Stereum sanguinolentum. There were a few scattering cases of infection by some of the common saprophytic wood-rotting fungi and some damage by carpenter ants. The following table gives the relative importance of these agencies at Gale River:

Cull Percentage by Causal Agents
Based on Merchantable Volume, 409 Trees

Causal Agent	Cull percent	Percent of Trees Affected
Butt Rots	4.5	41.8
Red Heart	2.9	7.1
Miscellaneous Rots	.2	.5
Ants	.3*	3.0
	7.9	47.9**

*Cull cases produced by ants and butt rot together are included in the butt rot cull per cent.

**Twelve trees had both top rot and butt rot in them, and six trees had both ants and butt rot in them.

Decay was found to be correlated with age but not with diameter or vigor of the trees. On poorer sites the stand is breaking over to a considerable degree from the weakening of the trees by butt rots, indicating the need for early harvesting to prevent rather heavy loss.

Two one-quarter acre plots of mature balsam fir were cut and examined for decay at Newcomb, New York. The three rots found in this species in New Hampshire were found to be causing loss here also. There were but two trees with ants. Several trees were killed by lightning and several by porcupines.

Progress for 1933

Another small stand of balsam fir which may be suitable for examination for decay has been located on the Gale River Experimental Forest and another area in Indian Township, Maine, will be investigated.

Reports

Spaulding, Perley and G. H. Hepting. One sheet of tables based on the Cherry Mountain plot showing total cull by the various principal agents and relation of age to decay. Typewritten. September, 1931.

_____. Investigation in decays of balsam fir I. Gale River Experimental Forest, New Hampshire. Typewritten, pp. 38, 1931.

Plans for Fiscal Year 1935

Studies along the following lines will be continued as far as possible on the areas under intensive silvical study in the White Mountains, New Hampshire, and in the Adirondacks of New York:

1. Reconnaissance of types of rot, their prevalence and external symptoms.

2. Detailed examination and dissection of diseased trees on selected areas. Determination of cull percent, age, and condition of tree, symptoms of disease, etc.

3. Culture work on the different rots to help in checking their identity.

Assignment

Bureau of Plant Industry, Perley Spaulding.

PROTECTION

Project

Heart Rots of Northern Hardwoods (Pd-8).

Scope

To determine the frequency and symptoms of heart rots in northern hardwoods, the significance of injuries leading to their entry, losses caused, relation of loss to external symptoms, and methods of management which will reduce their occurrence.

Status

Earlier observations showed that the heart rots seriously reduce the lumber yield in hardwoods of this region. In 1931 a number of selected trees showing various defects were felled and split open to permit study of rots within. Supplementary observations were made of logs decked on a rollway and of the output of defective logs at a sawmill.

Results

A set of rules for estimating cull in these species on the experimental forests has been formulated and distributed in the form of Technical Note 10.

Progress for 1933

In November an opportunity arose at Bartlett, New Hampshire, to make examinations for rot induced by various defects in hardwoods. It was found that yellow birches with low dead side branches 4" or more in diameter rarely have decay in the main trunk. The traditional resistance of this species to decay holds good with this type of defect. Overmature beech showed a large percentage of trees

with hollow butts which weaken them so that they are windthrown. Such trees apparently nearly ready to fall were found to have the rot running up only about 6 feet if there were no other defects in the top (other than large broken branches) or trunk. Defects in mid trunk indicate total loss for lumber. Large broken branches in the crown, 10" or more in diameter at the break, require 4 to 6 feet cull from resulting rot running downwards. Defect in mid trunk accompanying to above means total cull.

Opportunity arose for similar work on the Green Mountain National Forest in an overmature hardwood stand. Here it was found that rot from hollow butts in yellow birch and sugar maple trees about 200 years old ran up about 12 feet. Open scars on sugar maple trunks caused by the maple borer showed no rot--the entire defect would slab off in the mill. Fruiting bodies of the common decay fungi indicated rot as at Gale River and Bartlett in our earlier work.

Plans for Fiscal Year 1935

As funds allow, this work will be extended to other localities, conditions, and species. Culture work in connection with this project is being handled by a central laboratory in Washington.

Assignment

Bureau of Plant Industry, Perley Spaulding.

PROTECTION

Project

Control of the White Pine Weevil. (Pi-4)

Scope

To determine practical and effective measures for the control of the white pine weevil and for minimizing the damage caused by attacks.

Status

This project was begun in May 1925. Much of the work has been completed and published, particularly that referring to life history and habits. The examination of the permanent sample plots is to be continued indefinitely. Study of the plots laid out for the control of the insect and the minimization of the injury has been continued and in addition fertilization of the soil in a sample plot on the Harvard Forest is being carried on with a view of determining what effect increased vigor may have on attack by the weevil. The report on weather conditions mentioned in last year's Investigative Program was prepared but was not published as it was believed that another year or two would give more concrete information.

Results

The paper entitled "Additional Notes on the Improvement of Weeviled White Pine Plantations" brought out the fact that the ultimate form of attacked trees can be improved by the removal of infested tips before the new generation of weevils emerges. This operation enhances the probability of the eventual complete straightening of the crook at the point of death of the leader as well as reducing the population of weevils.

The Biological Survey has completed its study of the relationship of birds and animals to the white pine weevil. Although it appears that birds may not be expected to exert any appreciable control on the white pine weevil by feeding on the larvae, the investigation brought out considerable new information concerning the weevil. Among other things the average number of weevils recovered from each leader was greater than reported by previous investigators and the variety of secondary insects associated with the weevil was found to be greater than previously reported.

Progress for 1933

Weather conditions that were especially favorable for quick leader growth during the larval period in 1932 caused the death of many of the young larvae and resulted in a decrease in the emergence of adults. The winter of 1932-1933 was very open and this and inclement weather in April also aided in decreasing the number of adult weevils. Consequently there was a marked drop in the intensity of infestation thruout the entire Northeastern region. Study of the permanent sample plots showed that the average decrease in pure plantations was 45.3 percent and in the mixed stands was 72.3 percent.

The Reclamation Plots were remeasured and studied intensively; crop trees in many cases were pruned to a greater height and additional competing wolf trees were girdled.

Growth of the crop trees in the Reclamation Plots continued to increase in a satisfactory manner, the limb cuts are healing well and there is very little attack by such insects as the pitch midge and the pitch mass borer.

Miller has prepared a report on the relation of birds and animals to the white pine weevil and has also compiled detailed notes on the life history, feeding habits, and significance of a number of the secondary insects inhabiting weeviled white pine shoots which were observed in connection with his bird work studies.

In connection with the Emergency Conservation Work assistance and advice were given in selective pruning and girdling operations and also in weeding of white pine plantations. In Connecticut a project of removing weeviled tips was carried on from several camps under the supervision of the forestry and entomological departments of the Connecticut Agricultural Experiment Station. This project was considered so satisfactory that it is planned to continue it during the summer of 1934.

Publications and Reports

MacAloney, H. J. Notes on weather conditions affecting white pine weevil injury. Typed report 4 pages. Not submitted for publication.

Miller, J. P. Report on Investigations of the Relation of Vertebrate Animals to the White Pine Weevil. Typed, 53 pp. Not submitted for publication.

Plans for Fiscal Year 1935

The examination of the permanent sample plots will be continued. It is expected that, after another season's growth measurements are taken, a rather comprehensive report can be made on the improvement of the trees and the stands as a whole. Study of the fertilization plots will be continued and additional fertilization

may be carried on. The work in connection with the Emergency Conservation Program probably will be continued and it is hoped that a detailed study of the weeded areas can be begun and carried on for a period of years. This should make available valuable information on the amount of weeding which should be done in order to minimize the amount of future weevil attack. A study of the ability of white pine to straighten after attack is being conducted in cooperation with Doctor R. B. Friend, Connecticut Agricultural Experiment Station.

No new work on the project is contemplated by the Biological Survey.

Assignment

H. J. MacAloney, Bureau of Entomology, and J. P. Miller, Biological Survey, in cooperation with the Harvard Forest, Massachusetts Conservation Department, and the Connecticut Agricultural Experiment Station.

PROTECTION

Project

Miscellaneous forest and shade tree insects. (Pi-7)

Scope

To make incidental observations on the life histories and habits of miscellaneous forest and shade tree insects and to carry on brief experiments on control measures. To answer inquiries on this subject and to collect insects and samples of the injury so as to augment the collection of each that is already on hand.

Status

This project will be carried on incidentally with the other work.

Results

This has been carried on as a part of the work of the entomologist stationed at the Northeastern Forest Experiment Station since 1925. A considerable collection of insects and insect injury has already been made and has been arranged in cases and riker mounts so as to be available for examination at any time.

Progress for 1933

The Mound Building Ant Control project, carried on in cooperation with N. W. Hosley, Harvard Forest, was completed in 1933. A manuscript entitled "Experiments in Simplified Control of Mound-Building Ants in the Forest" has been prepared and probably will be submitted to the Journal of Forestry.

Due to the necessity for stringent economy the proposed work on Hylobius pales and Hypomolyx piceus was not carried on.

During April and May some time was spent scouting the western part of the State of Connecticut for evidence of the Felted Beech Coccus, and in early October a few days were spent scouting for Scolytids in connection with the Dutch Elm Disease Survey.

Sample plots for the study of the survival of larvae of the Locust Borer were laid out in southeastern New York for Doctor R. C. Hall, of the Central States Forest Experiment Station. As in the case of previous work on this problem by Doctor Hall, it was found that there is a relation between vigor and crown class and the survival of the larvae; vigorous dominants and codominants had the least survival, and overtopped trees the greatest survival.

A looper, Ellopia athasaria Walk. defoliated considerable areas of pitch pine throughout the Northeast during the past summer. Specimens were obtained, bred, and sent to Washington for determination. No investigative work has been done on this insect yet.

In parts of New Hampshire balsam fir was heavily attacked by a woolly aphid (probably Adelges piceae Ratz. and perhaps also A. nusalini Borner). The former species has been prevalent in Maine and New Brunswick for some time and is being studied in both regions. No investigative study has been initiated by the Bureau of Entomology up to the present time.

Publications and Reports

MacAloney, H. J. and Hosley, N. W. Experiments in Simplified Control of Mound-Building Ants in the Forest. 12 pp., typed manuscript to be submitted to the Journal of Forestry for publication.

Plans for Fiscal Year 1935

This work will be carried on indefinitely and work will be done on miscellaneous insects when it is possible to do so. It is hoped that funds may be available to initiate a study on the balsam woolly aphid in 1934.

Assignment

Bureau of Entomology, H. J. MacAloney.

June 29, 1934

NORTHEASTERN FOREST EXPERIMENT STATION

1. Budget by Projects

Project	SI Forest Management
Bp - Phenology	$ 749
F-1 - Planting	8,850
M-1 - Spruce Management	7,600
M-2 - Central Hardwoods) M-3 - Pine and Hemlock)	1,920
ME-3- Northern Hardwoods	9,810
Pf-2- Fire Weather	1,630
Pf-3- Fire Damage	4,800
Total	$35,359

2. Budget for Salaries and Miscellaneous Expenses - see Atlas size Form No. 2 Report, May 31, 1934.

3. Estimated Distribution of Direct and Overhead Expenditures Fiscal Year 1935

Sub-Appropriation	Direct	Overhead	Total
Forest Management	$23,716	$11,643	$35,359

FOREST BIOLOGY

Project

The interrelation of wild life and forest management.

Scope

To study the relation of birds and mammals to the forest through their food habits and to study the effect of the various practices of forest management upon habitat conditions for wild life, with especial reference to game species.

Status

The State of New Hampshire has placed the Pillsbury State Forest, with an area of about 3,000 acres, at the disposal of the Biological Survey for the project and Miller has taken up residence on the tract. Systematic observations of the wild life population of the forest are under way. A type map of the entire area is being prepared by a C.C.C. crew. Wild life reconnaissance of the Bartlett Experimental Forest in New Hampshire and of the Chenango Experimental Forest in New York was made in the fall of 1933.

Plans for Fiscal Year 1935

To push the survey and development of the Pillsbury Tract the southern portion of the forest will be devoted particularly to experiments in creating conditions favorable to an increase in the population of ruffed grouse. Periodic reconnaissance of wild life conditions on other experimental forests in the region will be continued, with especial effort to note changes in wild life conditions resulting from silvicultural operations and fire.

Assignment

J. Paul Miller, Biological Survey.